CALORIC CONTENT IN SOME FRESHWATER AND MARINE FISHES FROM GREECE

by

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SUMMARY.– Nine freshwater and eight marine water fishes are analysed for caloric content. All values are about 5000 cal. g^{-1} dw ; there is no statistically significant difference between the two groups.

RESUME.– Neuf poissons d'eau douce et huit poissons marins ont été analysés pour déterminer leur équivalent calorique. Toutes les valeurs sont voisines de 5000 cal. g^{-1} dw ; il n'y a aucune différence statistiquement significative entre les deux groupes.

INTRODUCTION

Since the time Lindeman (1942) proposed trophodynamic aspects, the use of terms like "energy flow" for understanding the function of ecosystems becomes more frequent. This could be expected since energy units are the only common ones in ecological systems. So, during the last years available information on caloric equivalents has been accumulating but we are far from sufficient quantitative data especially in some animal groups such as fishes. The result is that when energy equivalents are needed the same values already available in the bibliography are always used.

In 1971 Cummins and Wuycheck presented the first almost complete catalog of available data on caloric equivalents. About 20 species of fishes are included ; the mean value reaches 5086 cal. g^{-1} dw for Osteichthyes. Previously, Richman and Slobodkin (1960) emphasized the constancy of the caloric value of animal material and with the exceptions of starvation or storage conditions showed that animal tissue averages 5000 cal.g^{-1} dw. Data from Golley (1961) support their conclusion.

During the past decade some more information on fishes appeared but again no more than ten species were analysed, mostly of economic importance and under different trophic regimes cultures (Mackinnon, 1972 ; Solomon and Brafield, 1972 ; Pierce and Wissing, 1974 ; Meakins, 1974 ; 1976 ; Staples, 1975 ; Staples and Nomura, 1976 ; Elliot, 1976 ; Li and Brocksen, 1977 ; Cole, 1978 ; Diana and Mackay, 1979 ; Wooton *et al*, 1980 ; Flowerdey and Grove, 1980). Though different experimental conditions were applied the mean values of caloric content

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are very similar to the value proposed by Richman and Slobodkin (1960).

Based on the above observations we consider interesting to measure the caloric content of some fishes from fresh and marine environments.

MATERIAL AND METHODS

Collection of fishes was done during May 1979 in northern Greece. After collection, the material was carried to the laboratory in a portable cooler at 0°C. It was oven dried at 70°C to constant weight. The dried samples were homogenized in a blender. The homogenized material was stored into plastic bags till burning. The material was burned in the form of compressed tablets weighing 0.8 to 1.5 g.

To determine the caloric content, a Parr adiabatic calorimeter was used, in which samples were ignited at an oxygen pressure of 32 atm. The calorimeter was standardized with benzoic acid tablets. There were made two measurements per sample and only in case the variation ranged higher than 5 % a third one was made.

RESULTS AND DISCUSSION

Table I contains data on caloric content of fresh water fishes. The following conclusions are deduced :

The highest value was observed in *Leuciscus cephalus* (5605 cal.g^{-1}dw) while the smallest in *Rutilus macedonicus* (4647 cal.g^{-1}dw). The latter value can be attributed to the high ash content (20.6%). When the caloric content is calculated on ash free dry weight basis differences become much lower. In general, it seems very interesting that the mean value is 5069±119 cal.g^{-1}dw, very close to the measurements of Richman and Slobodkin (1960), Golley (1961), Cummins and Wuycheck (1971).

Concerning with marine fishes (Table II) the caloric values ranged from 4111 cal.g^{-1}dw *(Lophius piscatorius)* to 5416 cal.g^{-1}dw *(Trachurus trachurus)*. Again the lowest value can be attributed to the high ash content (21.6 %). The mean value was 4870±172 cal. g^{-1}dw. Comparison of fresh and marine water fishes showed caloric values which are not statistically significantly different, at the 0,05 level.

All values mentioned above are very close to the published data, so, the energy equivalent of adult fishes can be taken in the future as 5000 cal.g^{-1}dw under natural conditions.

Table I. Caloric content in some freshwater fishes of North Greece.

Species	Family	cal.g^{-1}dw	ash (%)	cal.g^{-1} ash free dw
1. *Leuciscus cephalus* (L.)	Cyprinidae	5605	10,0	6226
2. *Barbus meridionalis* Risso	Cyprinidae	5420	10,3	6050
3. *Gobio gobio* (L.)	Cyprinidae	5323	12.7	6104
4. *Alburnus alburnus* (L.)	Cyprinidae	4713	14.4	5516
5. *Rhodeus sericeus amarus* (Bloch)	Cyprinidae	4714	17.3	5683
6. *Alburnoides bipunctatus* (Bloch)	Cyprinidae	5206	14.0	6053
7. *Rutilus macedonicus* (Steindachner)	Cyprinidae	4647	20.6	5853
8. *Sabanejewia aurata* (Filippi)	Cobitidae	4797	14.9	5632
9. *Cobitis taenia* L.	Cobitidae	5196	13.8	6235
		5069±119	14.2±1.1	5928±89

Table II. Caloric content in some marine water fishes of Greece.

Species	Family	cal.g^{-1}dw	ash (%)	cal.g^{-1} ash free dw
1. *Trachurus trachurus* (L.)	Carangidae	5416	11.7	6173
2. *Merluccius merluccius* (L.)	Merlucciidae	4952	11.6	5611
3. *Micromesistius poutassou* (Risso)	Gadidae	5350	14.9	6291
4. *Lophius piscatorius* L.	Lophiidae	4113	21.6	5240
5. *Lepidorhombus boscii* (Risso)	Scophthalmidae	4632	14.1	5394
6. *Trigla lyra* L.	Triglidae	4927	15.9	5877
7. *Pagellus bogaraveo* (Brünnich)	Sparidae	4555	17.7	5550
8. *Diplodus annularis* (L.)	Sparidae	5018	15.8	5965
		4870±152	15.4±1.2	5761±133

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